IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/28/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 1/28/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

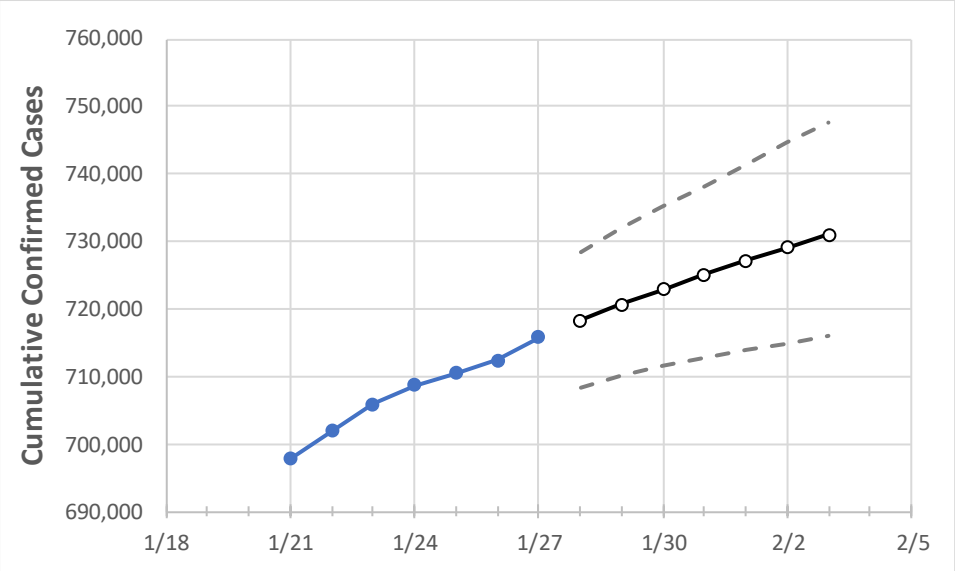
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Tennessee State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Tennessee	708,717	710,427	712,406	715,806	718,271	720,644	722,884	725,073	727,101	729,060	730,967

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Tennessee Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Blount	12,366	12,382	12,443	12,491	12,539	12,587	12,630	12,672	12,714	12,752	12,792
Davidson	73,045	73,248	73,395	73,910	74,181	74,447	74,709	74,972	75,217	75,458	75,700
Hamilton	35,861	35,983	36,114	36,369	36,500	36,622	36,742	36,854	36,960	37,058	37,152
Knox	40,173	40,335	40,479	40,739	40,909	41,070	41,228	41,380	41,527	41,671	41,808
Rutherford	34,166	34,271	34,354	34,539	34,655	34,767	34,871	34,966	35,060	35,150	35,234
Shelby	78,795	79,025	79,215	79,637	79,938	80,237	80,514	80,785	81,049	81,301	81,553
Sumner	18,819	18,862	18,891	18,985	19,049	19,112	19,169	19,225	19,277	19,332	19,380
Williamson	22,175	22,259	22,359	22,533	22,635	22,734	22,831	22,926	23,018	23,113	23,201

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Tennessee Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Blount	12,366	12,382	12,443	12,491	12,587 (2,517) [604] {302}	12,672 (2,534) [608] {304}	12,752 (2,550) [612] {306}
Davidson	73,045	73,248	73,395	73,910	74,447 (14,889) [3,573] {1,787}	74,972 (14,994) [3,599] {1,799}	75,458 (15,092) [3,622] {1,811}
Hamilton	35,861	35,983	36,114	36,369	36,622 (7,324) [1,758] {879}	36,854 (7,371) [1,769] {884}	37,058 (7,412) [1,779] {889}
Knox	40,173	40,335	40,479	40,739	41,070 (8,214) [1,971] {986}	41,380 (8,276) [1,986] {993}	41,671 (8,334) [2,000] {1,000}
Rutherford	34,166	34,271	34,354	34,539	34,767 (6,953) [1,669] {834}	34,966 (6,993) [1,678] {839}	35,150 (7,030) [1,687] {844}
Shelby	78,795	79,025	79,215	79,637	80,237 (16,047) [3,851] {1,926}	80,785 (16,157) [3,878] {1,939}	81,301 (16,260) [3,902] {1,951}
Sumner	18,819	18,862	18,891	18,985	19,112 (3,822) [917] {459}	19,225 (3,845) [923] {461}	19,332 (3,866) [928] {464}
Williamson	22,175	22,259	22,359	22,533	22,734 (4,547) [1,091] {546}	22,926 (4,585) [1,100] {550}	23,113 (4,623) [1,109] {555}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.